

## A PROPOSAL FOR SIMULTANEOUS TRAINING OF READING AND WRITING SKILLS BASED ON A CASE OF DOCTORAL ENGINEERING STUDENTS

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**Abstract:** *Writing academic papers is an essential skill that all doctoral students must acquire as from the very beginning of their studies they are required to publish the results of their research in English. For the last four years I have been concerned with preparing PhD students for their future careers, paying particular attention to their writing skills. As a result, I have identified three recurring issues that have been posing a particular challenge to ESP teachers: structural shortcomings (e.g. confusing paragraph structure), overwhelming stress on visuals rather than verbal description, and a lack of discussion. As a remedial practice I propose simultaneous training of skills, reading and writing in this case, with a particular stress on cognitive and metacognitive strategies. Employing cognitive processes in training reading skills necessarily leads to greater self-awareness in the writing practice.*

**Key words:** *writing, reading, cognitive and metacognitive strategies, doctoral engineering students.*

Writing skills are an essential selling point for doctoral engineering students. No matter whether their career takes them to industry or keeps them in the academia, research reports will be the bread and butter of their profession. The several years of pedagogical experience with teaching doctoral students at the Faculty of Mechanical Engineering, Brno university of Technology, have given me an insight into the rather dismal situation at Czech Universities. Not only do doctoral students have underdeveloped writing skills but both in their previous and current studies there is very little space for training writing either in their mother tongue or in English. Based on the most common faults in doctoral students' papers – structural problems, lack of description of visual material and language of discussion – I propose a development of writing skills based on a simultaneous training of reading skills. Reading skills can be developed in any class through a discussion between the students and their teacher while writing is mostly a solitary activity. Reading skills, particularly trained by concentrating on cognitive and metacognitive strategies, may significantly contribute to the development of writing.

Writing is an undervalued part of the technology curriculum at Czech universities. Students do not conceive of writing as an essential part of their future professional or academic lives. "I want to be an engineer not a writer" is the most common response to an option to take a writing class in English. This viewpoint is, unfortunately, supported by no compulsory elementary writing and composition classes at most Czech universities. The only class remotely touching on writing is in their third year of bachelor's studies when they take the diploma thesis seminar which is centered on how to write a bachelor thesis. Taught by experts in a particular field only, without any help from language experts, the focus is primarily on the requirements of the discipline and some formal features, such as citation standards. A similar seminar is then taken at the end of the master's studies. Lacking the rhetorical and genre background in Czech, it is no wonder that students struggle with writing in English. Moreover, first-year doctoral students are unpleasantly surprised to find out that most of their future writing will not only be academic journal articles but journal articles in English, English being the lingua franca of the contemporary academic community. For this reason, their struggle is

manifold: they have to learn English at the C1 level of CEFR, they have to master writing academic journal articles, and they have to join these two skills into writing journal articles in English.

The underlying background for this paper has, of course, been my experience with teaching doctoral students. Since 2013 I have been trying to use the insight from the doctoral courses as an input for their improvement and also development of new courses. Taking into consideration that remedial practice in doctoral studies can be made redundant on condition that students are taught writing from the early stages of university studies, I have designed a course of technical report writing for bachelor's and master's students and a research paper writing course for master's and doctoral students. The following instances of faults in doctoral students' papers were only some of the incentives that led to designing these courses, especially the more advanced one, and to a constant development and re-evaluation of the doctoral studies course.

Structural shortcomings are probably the most frequent issue that I have encountered in doctoral students' papers. They include:

- fragmented paragraph structure (frequent one-sentence paragraphs),
- unskillful abstract or introduction structure (delaying the keywords or starting with another part than the topic),
- stating the thesis statement in the abstract but not in the introduction,
- stating the obvious, especially in the conclusion.

Considering the above-mentioned situation of writing classes in the Czech Republic, as teaching practice I propose simultaneous training of reading and writing skills. Reading skills form a necessary first step towards successful writing especially if cognitive processes and cognitive and metacognitive strategies are foregrounded.

My proposal for simultaneous training is theoretically grounded in the study of Fitzgerald and Shanahan who discuss the relationships between reading and writing skills and their mutual development and assert that "reading and writing rely on analogous mental processes and analogous knowledge" (2000, 39). Even though there are also significant differences between the two skills, research into reading-writing relationships has identified three main approaches to training these skills (Fitzgerald and Shanahan 2000, 39–40):

- rhetorical relations based on the assumption that reading and writing are complementary communication activities,
- procedural connections viewing reading and writing as activities employed towards a common goal,
- shared knowledge and cognitive processes between reading and writing.

Even though Fitzgerald and Shanahan then focus only on the last approach, they state an important fact which is that reading and writing are connected "because they depend on identical or similar knowledge, representations, cognitive processes, and contexts and contextual constraints" (2000, 40). This stress on cognitive processes and conscious mental activities is a basis for my proposal that writing can be taught through reading.

If the connection between reading and writing is cognition, then the importance of cognition in the widest sense of the word has also been recognized by Rebecca L. Oxford in her several studies on language learning strategies. Oxford defines a strategy as "a plan that is consciously aimed at meeting a goal" (2003, 274). The element to be stressed is the word "consciously." Only conscious endeavor can lead to success. Oxford (1990) offers a useful classification in which most strategies are usually involved in teaching language skills:

- cognitive strategies,
- metacognitive strategies,
- memory-related strategies,
- compensatory strategies,
- affective strategies,
- social strategies.

It is the first two strategies that play a particular role in the simultaneous training of reading and writing skills. The cognitive strategies include receiving and sending messages, reasoning, analyzing, note-taking, summarizing, synthesizing, outlining, and reorganizing information to develop knowledge structures (Oxford 1990, 44). All these strategies are employed by students in their first language when studying. Analogously, a wide range of cognitive strategies must be present in the second language learning too. Probably even more than cognitive strategies, it is the metacognitive strategies that are tightly connected to a conscious use of language. These include gathering and organizing information, setting tasks, monitoring mistakes, and evaluating task success (Oxford 1990, 137). Several studies have shown that “strategic awareness and monitoring of the comprehension process are critically important aspects of skilled reading [...] unsuccessful students lack this strategic awareness” (Martínez 2008, 166). Reflecting on the process of how students arrive at a particular answer to a reading-comprehension question/test item should be an essential part of the learning process.

This asks for metacognitive-strategy training which has been discussed by many researchers (e.g. Mokhari and Reichard 2002). Particularly in the area of ESP where students read texts with a particular agenda in mind, metacognitive strategies play a crucial role. Reading skills, and by extension writing skills, should be developed by raising students’ awareness of the rhetorical structure of texts, by explicit instruction on the discourse and syntactic, grammatical and lexical features of texts in the students’ field of expertise. This means not only reflecting on how students read a text but also how the text was composed. While cognitive strategies involve thinking, metacognitive strategies rely on “thinking about thinking,” i.e. reflecting on when and how to use particular thought patterns. Teachers involved in skills training should thus constantly bear in mind the crucial role of metacognitive processes.

One more remark should be made. Even though it seems logical to presume that reading strategies will differ by the field of students’ study, Vaez Dalili and Tavakoli (2013) prove that the overall pattern of the use of reading strategies is the same for students of humanities and engineering students. Both groups of students were found to use the following hierarchy of metacognitive strategies in the descending order: global reading strategies, problem solving strategies, and support reading strategies (Vaez Dalili and Tavakoli 2013, 71). The only difference was that engineering students tended to use these strategies more frequently than the students of humanities. Vaez Dalili and Tavakoli interpret the differences in frequency as “inherent requirement of the two different fields of study” (2013, 72). I do not feel completely competent to interpret other scholars’ research, but the implication seems to be that technical texts require a more frequent and conscious use of reading strategies, which only makes the training of reading skills more relevant.

The reliance of reading and writing on analogous mental processes and knowledge, the stress on cognitive and particularly metacognitive strategies, and the training of higher order skills are the key to mastering writing in my Research Paper in English course. This experience coincides with the research of Kumari, also conducted on students of engineering, who emphasizes that “involving students in the cognitive processes of writing (e.g., defining the rhetorical problem, identifying the rhetorical situation, determining the audience, setting goals for writing, planning for the text by generating, and organizing ideas) is necessary” (Kumari 2016, 1). The cognitive processes are

developed in my course in two reading tasks that subsequently lead to the writing task. In those classes devoted the individual parts of research papers (abstract, introduction, literature review etc.), students are first given a lead-in reading task with a variety of questions to discuss in pairs or groups. The main reason for this discussion is to raise the students' awareness of the typical features of the individual parts of academic papers. The ability trained here is that of reasoning through discussion because it is the tool of discussion "regarding the construction of a text and the way language works in various text types [that] facilitates better writing" (Kumari 2016, 1). Such lead-in reading tasks should present a work plan for the students' future writing, which was the reason why I tried to select textbook texts prepared as prototypical examples. They should also involve more than one skill – in this case reading, speaking and note-taking – and have a clearly defined communicative outcome – which is to be a manual for the subsequent written passage. Yet nothing is ever ideal and giving students only ideal examples to think about would not be preparing them for real-life situations. Therefore, the particular class is concluded by an application of the learned rhetorical, lexical, syntactical, grammatical and other features to a real text. These texts have been chosen from previous doctoral students' submissions so that the rhetorical situation of these texts is the same. Once again, these application tasks displaying both positive and negative features involve cognitive demands on the students' reasoning – they are not only required to apply the learned knowledge but also to evaluate possible variations of the set examples. These in-class reading tasks are, of course, only a set-up for a subsequent take-home writing assignment.

The other issue I would like to focus on is engineering students' overwhelming preference for visual representation as opposed to verbal representation. Even though visual material is essential in doctoral students' papers, the visual and verbal parts should be balanced. Engineering students' deficiency in dealing with symbolic and abstract information is evident in the Results and Discussion parts of their papers. Students' Results sections usually feature only very sketchy description of tables or graphs, leaving it up to the reader to study the visuals without the author's guidance. Furthermore, their focus on concrete facts makes it difficult for them to write the Discussion part where they are expected to derive general points, relationships and implications.

Most studies dedicated to the learning styles of engineering students are rooted in Richard M. Felder and Linda K. Silverman's seminal 1988 paper "Learning and Teaching Styles in Engineering Education" which then led to the development of the Index of Learning Styles. In this index, Felder differentiates the following contrasting learning styles: sensory vs intuitive perception, visual vs verbal input, active vs reflective processing, and sequential vs global understanding. The results of various research are very similar. Engineering students prefer sensing and visual input, active processing, and sequential understanding (Kolmos and Holgaard 2008; O'Dwyer 2010; Rosati 1999).

Being sensory learners, engineering students prefer concrete facts to abstract ones and are less comfortable with symbols, i.e. language. The visual-verbal preference is usually the one that is the most statistically significant. For example, an American study reports that in its sample only 6.8 % of students preferred verbal input, 49.2 % had no strong preference and 44.1 % were more visually oriented (Baukal and Ausburn 2014). The authors then suggest that teachers of engineering subjects should design highly visual materials representing concrete facts to facilitate students' learning (Baukal and Ausburn 2014, 13). A similar idea is expressed by Rosati who argues that "in an ideal learning environment [...] teaching should appeal to a range of learning styles such that each student, at least for some of the time, is able to learn in their own preferred style" (1999, 21). This implication is, of course, logical and there is nothing wrong with preferring to study visual to verbal material unless it starts to hinder the students' own academic progress.

The same researcher, Peter Rosati, interestingly found out that although engineering faculty prefer to learn by visuals, like their students, they predominantly teach in spoken and written word and written mathematical expressions. Also, the faculty preferred reflective rather than active processing

(1996, 1443). The shift from visual learning and verbal teaching and from earlier active processing of undergraduate students to later reflective processing of their teachers poses a fertile ground for speculation. I do not favor simplistic explanations that teaching in words is easier than developing demonstrations and designing visuals. The root of the issue, in my and also Rosati's opinion, is the growing experience, expertise and academic progress. This cognitive shift is reflected in the description of visuals and the presence of discussion in academic and research papers. Doctoral students, to conform to the demands imposed by the style of academic writing, have to switch from simple visual presentation of their research results to a balance of visuals and verbal description, to thorough interpretation of results and to reflecting on the significance of their results, possible limitations or implications of their research, which is shown in the discussion section. To help students strike this balance, a variety of reading examples should be presented in the writing classes. Following the same strategy mentioned above, I select a wide range of descriptions of visuals both from textbooks and actual research papers, which then serve as reading samples for class work. Followed up by a group or class discussion, the reading samples do not only help develop students' reading skills but they also make them realize the different functions of visual material and written description, to rationalize the need of complementary information input provided to the reader by the two media, and to regard the differing interpretations of their fellow students as a valuable base for their own Discussion sections. In this way, training reading results in a conscious construction of knowledge and mental processing of given input which forms a firm ground for follow-up writing activities.

A simultaneous training of reading and writing skills has been proposed in this paper based on observed shortcomings in doctoral students' research papers. Reading and writing skills are complementary communicative activities based on analogous mental processes. As such, reading activities may compensate a lack of writing opportunities by developing cognitive and metacognitive strategies. Cognition means a construction of knowledge, which in this case means that well-developed reading skills form a sound base for writing skills. This is, however, not to say that reading is a cure for writing. Without follow-up writing practice, this endeavor would be quite futile.

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